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The MODEL ENGINEER

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SMOKE RINGS

Our Cover Picture

● THIS WEEK our cover picture is a photograph taken during the Press preview at this year's exhibition.

I am unable to comment upon detail or draw your attention to some interesting feature, for as I write this Smoke Ring the picture has yet to be taken. I am planning to select a view which will, I hope, convey to readers the fascination and enjoyment which a finely-executed model gives, not only to its creator, but to the many hundreds who by its inclusion in the exhibition will be able to share that pleasure.—P.D.

Gift of Technical Books

● I HAVE now heard from the lady on whose behalf I recently invited applications for the disposal of her late brother's technical books. She writes : I have been able to make what I think my brother would have considered a good choice in deciding to send them to the apprentices' library of an engineering works at Lang Bridge, Accrington. I think the years of his own apprenticeship were among the happiest of my brother's life, and I know that to lend a helping hand to other lads in their apprenticeship-days would have appealed to him greatly."

I take this opportunity of acknowledging and thanking all others who replied, to whom, owing to the great number, my correspondent is unable to reply individually.—P.D.

The Common Bond

● IN THE issue of THE MODEL ENGINEER for July 12th, 1945, there appeared an article by Mr. S. H. Milligan of Surrey Hills, Victoria, Australia, describing the live steam, passenger-hauling track which he constructed in his garden. At the end of the article, he gave his address and an invitation for anyone in the vicinity to pay him a visit. Recently, I received from Mr. E. E. Hadfield of Croydon, Australia, who is also a model railway enthusiast, a letter which contained the following paragraph :

"A while ago, I, along with two friends, went to Surrey Hills, a few stations nearer Melbourne, and spent an enjoyable afternoon at the house of Mr. Milligan, whose garden railway was illustrated in THE MODEL ENGINEER a couple of years ago. We gave him a tinkle on the telephone as he invited us to do in his article, and we were made most welcome and spent a very enjoyable afternoon. There were about nine engines 'doing their stuff' that afternoon. We also had the pleasure of seeing some moving pictures taken during

the construction of the line, and of some of the engines in action. We also saw several bits and pieces belonging to 'Hielan' Lassie,' which is under construction in the locality."

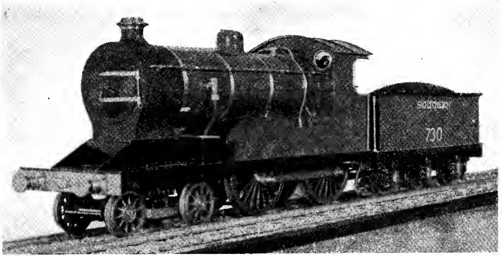
Here, once again, is a typical example of the bond of common interest existing between model engineers the world over, and it is not without a feeling of pride and satisfaction that we learn that THE MODEL ENGINEER has been responsible for the formation of an enjoyable acquaintanceship between readers on the other side of the world.—P.D.

An Australian "Dairy Maid"

● IT DOES not matter in which part of the world a locomotive by "L.B.S.C." is built, the result is always a success, provided that the well-known "words and music" are strictly followed for all jobs, and his wonderful twenty-five years' non-stop run." Mr. Meyers adds that he is now busy on an engine for "1831" from a set of Mr. Haselgrove's castings, and says that the bits and pieces "simply fall into their correct places"—a nice little tribute to E. T. Westbury's design.—J.N.M.

The Atomic/Steam Era?

● IN A paper read by Andrew Kalitinsky before the Detroit section of the Society of Automotive Engineers, he stated that the type of engine most likely to be adapted to utilise atomic energy is the closed-cycle steam turbine, the steam being generated in a nuclear reactor, or pile, by the heat released there. After expansion through the conventional type of turbine,



A *"Dairy Maid" built by Mr. V. S. Meyers of Melbourne, Australia*

essential details. From Mr. V. S. Meyers of Melbourne, Australia, I have received the photograph reproduced on this page. The engine is of interest on account of a few modifications which Mr. Meyers has made, mainly through force of circumstances. He writes:—"This locomotive has been about twelve years in building, due to lack of spare time. She has Joy valve-gear, and the cylinders are $1\frac{3}{16}$ in. bore, because I happened to have a reamer of that size. The boiler is 4 in. dia., not $4\frac{3}{8}$ in. as specified, which means a couple of tubes less. But she steams well and upholds her designer's ideas on the subject of big cylinders and small boilers. I did not like her appearance with the circular extended smokebox, so went back to the old pattern as used in the pre-superheater days, with good results as to her looks and performance. Apart from some difficulty in getting the boiler to sit low enough on the frames, due to the use of outsize hornblocks, I experienced no troubles, and I congratulate 'L.B.S.C.' on his splendid instructions, his knack of simplifying difficult

the steam then passes through a condenser and is forced back into the boiler by a feed pump.

It may give some consolation to lovers of steam engines to know that although reciprocating engines will eventually become obsolete, the steam turbine may well become the prime mover of the next century.—P.D.

There is Still Time!

● ON SATURDAY next there will close what surely must be the finest exhibition of model engineering craftsmanship ever staged in this or any other country in the world.

If you have not yet visited the MODEL ENGINEER Exhibition, now running at the New Royal Horticultural Hall, Westminster, there is still time for you to do so.

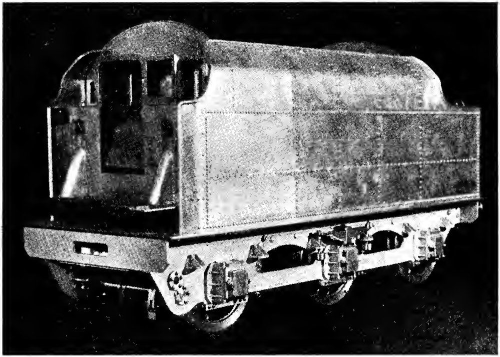
If I were asked for my impression of the principal reaction of visitors, I would say almost invariably it is an expression of amazement at the hours of patient concentration which must have gone into the construction of the many fine examples of model-making.—P.D.

A 1-in. Scale "Royal Scot" Tender

by George F. Archer, A.M.Inst.B.E.

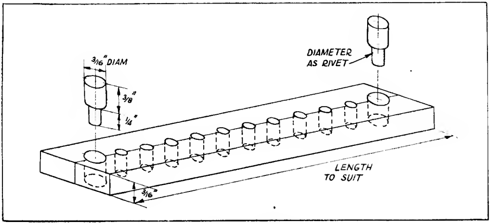
HEREWITH are reproduced a few photos of my partly completed tender. This is to 1-in. scale to suit my rebuilt 'Royal Scot," and I feel I must acknowledge the courtesy and help I received in obtaining data, etc., also facilities for making sketches, from Mr. Savage, of the L.M.S. Railway at Euston. I must also thank that friend of all locomotive builders, "L.B.S.C." I know that, without the knowledge I have gained from his weekly articles I could never have even attempted my present project. May I also pay tribute to that master craftsman Dr. Bradbury Winter who, particularly in attention to detail, has given us all a standard to aim for.

I started on my locomotive on January 16th 1947, after making some 140 sketches, etc., and after obtaining in the boiler, frames, wheels, etc., something roughly like its prototype, I paid several visits to the *Model Engineer* Exhibition. There, as usual, I saw work which made me feel disgusted with my own humble efforts and made me determined to do better. I also saw a few faults in several jobs (don't we learn a lot at the *Model Engineer* Exhibition) which I thought I might try to eliminate in my own job. The week after the show, I started with the wheel castings which, by the way, are correct 1-in. scale L.M.S. tender wheels, and these are the only castings in the tender. These didn't take very long. The axles came next, which are again tapered from the centre outwards. I then started on the double framing and their stretchers (fabricated). I next made the brake blocks in exactly the same way as described by Mr. Maskelyne and our other friend. Where I differed was, after cutting the segments, I noticed the different radii on the prototype (similar to sketch). I found out the radius, made a slight cut on my faceplate to the radii, then clamped the segment to the faceplate, and the rest was easy.



A three-quarter front view. Note small name plates

The next operation was the brake beams, and I had a little bit of fun in turning the ends and then milling the rest on my vertical slide. The vertical slide was again used in the machining of the axleboxes, which have removable covers. The hornblocks and brake hangers were then fabricated and silver-soldered, and a spring built up. I started then upon the brake gear and put the chassis, etc., together. My next job was the



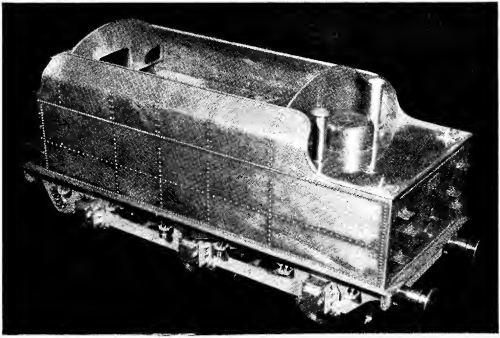
A drill jig for rivet holes

tender sides and soleplate. Here I must acknowledge the assistance of my wife (who has always taken a keen interest in my hobby), in the holding of the rather heavy tender sides ($\frac{1}{8}$ in. thick, $22\frac{1}{2}$ in. long), whilst I put in and riveted the 565 rivets in each side, also the remainder of the rivets, coming to nearly 3,000. One of the funniest jobs was the building of the inside coal chute. I made a simple wooden tool for bending the bevel gear guards which cover the hand brake gear and the water pick-up. Other items to finish are: doors (coal and food locker), iron tunnels, water pick-up, springs, steps, coupling hooks and steam brake cylinder.

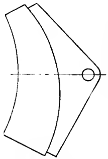
Riveting

With regard to the method I used in keeping the rivets fairly straight, I will explain that it is quite simple.

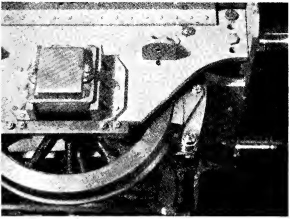
Every rivet is correctly pitched and in the correct position; also, all rivets, except the top ones on the curved part, are doing the same job as the real ones. The inside of the tender has correct-type angle brackets supporting sides and stretchers and they are riveted to sides. I have tried in a very humble way to emulate our



old friend Dr. Bradbury Winter, although I will never be a craftsman like him—he has set a standard to try for. The lifting-pieces and lamp brackets are riveted with correct size rivets as well, they are smaller than the ones in the tender sides 0.038 in. dia. I made these with a small tool. I have also made the small bevel gears for the water pick-up and hand-brake gear. When finished the coal doors will work. I am also putting in the steam brake gear and water pick-up.



Shape of brake blocks



Rear end of tender, showing axlebox and brake blocks

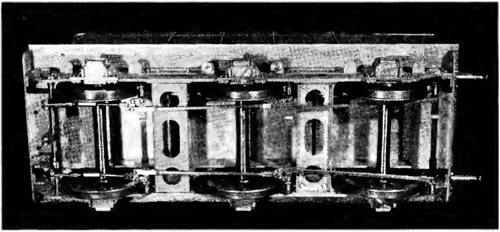
Readers will, perhaps, wonder why I have put the fairly correct inside tender detail in. I know it, perhaps, will never be seen, but, like Dr. Bradbury Winter, I can say " Well, it's there."

Mark out tender sides with straight lines. Make a small drill block, say with about 8 or 10 holes (rivet size). Mark out line on each end to correspond with centre-line. Starting from, say, left-hand side of tender, mark out carefully two holes same centres as end holes in block. Turn two small plugs. Place block over holes and insert plugs to act as locating pins, drill other 6 or 8 holes. After drilling, leave one plug in, swing block round until line on end of block registers with line marked on tender side. Use another small plug as centre punch (silver-steel hardened, etc.) Swing block out of way, drill hole, then insert locating plug and carry on as before The above may seem rather lengthy but it really takes very little time to drill hundreds of holes accurately.

Forming Splashers

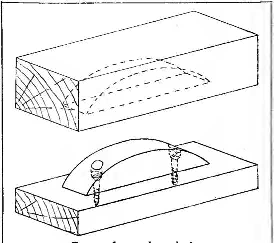
I made a small tool from hardwood for the wheel splasher, pressed out in vice, and without annealing. The tool is similar to sketch. I have not given sizes, but it can be used for any size of tender splasher.

In passing, I would like to say everything has been done in my little garden workshop.



Pit view of the 1-in. scale tender

Machine tools comprise a $3\frac{1}{2}$-in. Drummond lathe (I wouldn't part with this for untold wealth), a small bench drill, the lot powered with a $\frac{1}{4}$-h.p. a.c. Higgs motor. My other tools consist of the usual tools one finds in the average workshop. In my daily work (which is the supervision of apprentices at Percival Aircraft Co.), I see people using tools from jig-borers, etc., and all the usual tools one associates with precision engineering and have also used most of them myself; but I find the biggest kick in our hobby of model engineering is the using of one's simple tools in so many ways which encourages, I believe, initiative and assists to make our hobby so interesting and a relief from the worries which surround us today. I am of the sincere belief that, if one has all the tools one requires, model engineering or model making loses its interest and becomes a repetition of one's daily work. So, may I say, here's all the best to the fellow with his simple tools, and let us all try to show our fellow model engineers what can be done without the use of elaborate equipment.



Former for tender splashers

I have honestly tried to prove that building the tender first is a help; also, that a 1-in. scale tender can be built something like its prototype for passenger-hauling without destroying the character of the real thing and making the excuse "It was done for passenger-hauling purposes." By removing four bolts, the front of the tender comes right away and leaves plenty of room for getting at the cab. Also, I am truly desirous of encouraging the person with humble equipment by saying it can be done. No doubt, whilst it is very nice to have all the tools some of our more fortunate brothers possess, it is noticeable that most of the beautiful models which have won the coveted championship cup have been built with just ordinary equipment. To mention a few: A. Woodwards, J. Wyatt, S. J. Ward, R. Eborn.—I happen to have seen their workshops.

The Malden Regatta

THE Malden and District S.M.E. held their annual M.P.B.A. Regatta on July 18th, and the event turned out a great success. The regatta had been postponed from June 20th and definitely for the better, as far as the weather was concerned.

The new venue was the Kingsmere Pond, Putney Heath, and among these pleasant surroundings a grand day's sport was enjoyed by all.

The first event, a nomination race over a course of about 50 yd., resulted in a win for a miniature boat belonging to Mr. Angell (Malden). Several well-known boats ran close to time, although the course, being unmeasured, made the "guessing" more difficult.

Result		**Error**
1st.	Mr. Angell (Malden) *Diablette*	1 sec.
2nd.	Mr. Benson (Blackheath) *Comet*	2 9/10 sec.
3rd.	Mr. Griffin (S. London) *Victoria*	3 sec.

The second event was a mixed event for B and C Class racing boats, and Mr. Jutton, of the Guildford Club, again put up a fine show with *Vesta II.*

Results

Class C Prize: Mr. Philpot (S. London), 22.4 sec., 27 m.p.h.

Class B.: 1st, Mr. Jutton (Guildford), *Vesta II*, 17.5 sec., 35 m.p.h. 2nd, Mr. Cluse (Orpington), and Mr. Walker (Malden), *Petite*, 25 sec., 24 m.p.h.

After a short interval for lunch, the A Class racing boats competed over a 500 yd. course, and it was good to see very consistent running from most of the boats, Mr. Walker's *Gilda*, usually most well-behaved, being the only boat not to finish. Mr. Pinder (Malden), with *Rednip IV*, was back to form, recording good times on both runs.

Result

1st, Mr. Pinder (Malden), *Rednip IV*, 25 sec., 40.91 m.p.h.

2nd, Mr. Parris (S. London), *Wasp*, 29 sec., 35.27 m.p.h.

The final event was a Steering Competion, and this proved a most interesting event to watch, the scoring being very good, most boats managing to record a score of some kind.

Result

1st, Mr. Benson (Blackheath), *Comet*, 9 points.

2nd, Mr. Rayman (Blackheath), *Yvonne*, 8 + 3 points.

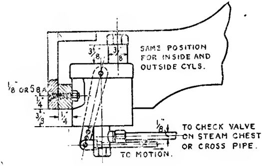
3rd, Mr. Whiting (Orpington), *Joan*, 8 + 1 points.

"MAID OF KENT" and "MINX"

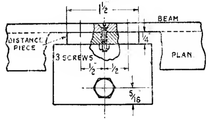
How to Erect Lubricators

by "L.B.S.C."

FROM time to time, beginners want to know why I don't specify mechanical lubricators erected on the running-board, same as on many full-sized engines. No. 1 reason is that it isn't advisable to run any risk of stinting the oil supply to non-ferrous cylinders, pistons, and valves when "redhot" steam is used, therefore the little lubricators have to be larger, and deliver more oil per stroke, than would be proportional to a full-sized engine. These outsize gadgets would be a bit of an eyesore mounted on the running-board, and would also be easily damaged in case of collision, derailment, or other untoward happening, which is reason No. 2; and what you might call "reason 2a" is that the driving arrangements can be better protected if the lubricators are erected somewhere between frames. My own pet location for the lubricator is between the buffer-beam and cylinders, where it is easy of access for filling, and can be taken out in a minute or so for adjustment or cleaning, when needed. On both "Maid" and "Minx" there is plenty of room for the lubricator in this position, as you will see from the reproduced drawings; and the erecting is reduced to the rockbottom of simplicity, not even a bracket being required.



Lubricator erected on "Maid of Kent"



Plan of lubricator erected

The erection is the same on both engines. A piece of $\frac{1}{2}$-in. by $\frac{1}{4}$-in. steel or brass rod, $1\frac{1}{2}$ in. long, is used as a distance-piece between lubricator and buffer-beam, and three countersunk screws go through the lot, as shown in sections, the nuts being inside the oil tank. Drill three No. 30 holes in the buffer-beam, $\frac{1}{4}$ in. from the bottom, the middle one being exactly in the middle, right under the drawbar hole, and the others at $\frac{1}{2}$ in. from each side; countersink them. Temporarily clamp the distance-piece to the beam, and drill through that as well, using holes in beam as guides. Then do ditto with the lubricator itself; a big toolmaker's cramp will hold it. Note, on the "Maid," the tank comes $\frac{3}{8}$ in. below the beam; and on the "Minx," $\frac{1}{2}$ in. shows. Take the lids off whilst doing this job; and when through, be sure to clear any chippings out of the tank. Also have the ratchet lever on the right-hand side of the engine. The lubricators can then be fixed in position by three $\frac{1}{8}$-in. or 5-B.A. screws, as shown. Instead of nuts, you could, if you so desire, drill three No. 40 holes in a bit of $\frac{1}{8}$-in. by $\frac{1}{4}$-in. brass rod, $1\frac{1}{2}$ in. long, using those in the distance-piece as guide, and tap them to suit the screws. Put this in the tank in place of the three nuts, and run the screws into them.

On the centre-line of the lid, $\frac{5}{16}$ in. from back, drill a $\frac{3}{8}$-in. hole; and in it, solder a short bit of $\frac{3}{8}$-in. tube (any kind will do) $\frac{3}{8}$ in. long for the "Maid," and $\frac{7}{8}$ in. for the "Minx." Turn up a simple "push-in" plug to fit the open end, from a bit of $\frac{7}{16}$ in. hexagon or round rod, just as you please. This forms a handy filler, saving the trouble of taking the lid off every time. No fixing is required for the lid, just snap it on. It should be tight enough to prevent jumping off when the engine is running, or falling off if she is turned upside down, for adjustments or cleaning.

How to Connect Up

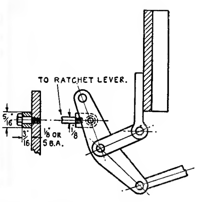
Oil is delivered *via* a $\frac{1}{8}$-in. pipe, to a small check-valve or clack-box screwed into the middle of the front wall of the steam-chest. By the good rights, the oil should be introduced into the flow of steam, so that it is atomised, and the spray carried by the steam to all the working parts; but I find the method shown, gives every satisfaction, and in the present instance it simplifies the connections. All my own inside-cylinder engines get their oil in similar manner, and there

has been no shortage on either valves, pistons, or rods.

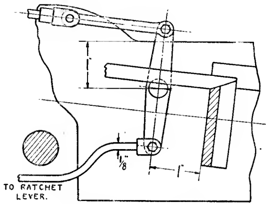
The check-valve is shown in section, and as it is made in exactly the same way as the one under the lubricator, no detailed description is called for. Suffice it to say that instead of carrying the $\frac{1}{4}$-in. by 40 union nipple in the side, a fitting, as shown in section, is turned up from $\frac{3}{8}$-in. brass rod and silver-soldered in. The lower end of the clack is turned down to $\frac{1}{4}$ in. diameter, screwed $\frac{1}{4}$ in. by 40, and countersunk for a union.

all right, as the illustrations will show. Incidentally, on one engine, I brought the valve spindles right through the front steam-chest wall, as she had horizontal cylinders, and connected one of them to the ratchet lever by a fork and short link, turning the ratchet-lever skywards instead of letting it hang down. It answered champion on that particular job, but won't do for either the "Maid" or the "Minx."

The illustrations show each drive separately, for the sake of making the job easy for beginners,



Drive connected to "boomerang" lever



Drive for Joy-geared "Minx"

Drill a 7/32-in. hole in the middle of the front wall of the steam-chest, tap it $\frac{1}{4}$ in. by 40, and screw in the clack, with a smear of plumber's jointing ("Boss White" or similar compound) on the threads, and have the nipple pointing downwards; but it doesn't matter a Continental about the inclination of the clack body, as the ball is spring-loaded. On my "Grosvenor," the clack is on its side, for convenience in attaching the pipe, as space at the leading end is in what bureaucrats call "short supply." The oil-pipe is merely a length of $\frac{1}{8}$-in. copper tube, with a $\frac{1}{4}$-in. by 40 union nut and cone on each end, and I have described how to make these so many times, that followers of these notes should be able to make them with their eyes shut. Tip to beginners: don't use too much silver-solder when attaching the cones to the pipe, or it will run over the turned surface of the cone, and you'll never be able to screw up the union oil-tight. I use "Easyflo" in wire form for jobs like these, and it is quicker and easier than using soft solder. The loop at the bottom of the pipe makes it much easier to connect up, and avoids a sharp bend.

How to Drive the Lubricator

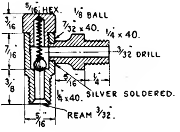
All we now need, is some means of connecting up the ratchet lever to some point on the motion, that will waggle it back and forth when the engine runs, and so deliver oil to the valves and pistons as required. This is usually a bit of a wangle, on an inside-cylinder engine, as the cylinders themselves get in the way; but it can be done

and I will briefly describe each. The first is for the "Maid" with Stephenson link-motion. The connection is made to the boomerang lever which operates the feed pump. At about halfway between the fulcrum-pin and the upper pin, drill a No. 40 hole, and tap it $\frac{1}{8}$ in. or 5-B.A. Next, make a little edition of the valve-spindle fork—you know how to do that—and tap the stem $\frac{1}{8}$ in. or 5-B.A. also. This is made from $\frac{1}{4}$-in. square steel, and the pinhole drilled No. 48, same as the holes in the ratchet lever. The slot should fit the ratchet lever nicely. For the other end of the drive-rod, file up a little bit of $\frac{3}{16}$-in. by $\frac{3}{16}$-in. brass rod to the shape shown, drill the square end No. 40, and tap $\frac{1}{8}$ in. or 5-B.A. Now put the boomerang lever in mid-position, by turning the coupled wheels, and have the ratchet lever straight down. Measure from the centre-line of the pinholes in the ratchet lever, to the middle of the hole in the boomerang lever, and that gives you the length of the drive-rod between centres. The drive-rod is just a length of $\frac{1}{8}$-in. round silver-steel, screwed each end to take the fork and the brass head. It will need bending a little to clear the pump, and offset slightly to line up with the ratchet lever, passing under the cylinders; a little bit of careful fitting and erecting. The crosshead or fork is pinned to the ratchet lever by a little bolt made from 5/64-in. silver-steel or 15-gauge spoke-wire, screwed each end 9-B.A. and furnished with commercial nuts. The drive head is pinned to the boomerang lever by a pin turned from $\frac{1}{4}$-in. hexagon steel, as shown in the sectional views. The plain part is

turned to a nice running fit in the hole in the drive head, and a shade over $\frac{3}{16}$ in. long, so that the head is free when the pin is screwed home tightly; the screwed part should be tight in the tapped hole, so that it cannot work loose when the engine is running. The ratchet should click one tooth for each revolution of the driving wheels. As it only takes about one beetle-power to drive the lubricator, the $\frac{1}{8}$-in. drive-rod will be found stiff enough to do the job without any intermediate support.

Drive for the Link-motion "Minx"

On the "Minx" with link-motion and a cross-head pump, we have a spare eccentric on the axle, which can be used for the lubricator drive. This will need a swinging intermediate link under the



Oil check-valve

motion-plate, to divide the drive and reduce the stroke. The bracket holding this may be either a casting or filed up from $\frac{1}{2}$-in. by $\frac{5}{16}$-in. bar material. Two No. 21 holes are drilled in it, for attachment to motion-plate; the lower end is slotted $\frac{3}{16}$ in. and cross-drilled for 5/32-in. pin, same as specified for the anchor-link fulcrum-pins of the Joy gear. The swinging link is a piece of $\frac{5}{16}$-in. by $\frac{3}{16}$-in. steel, $1\frac{1}{2}$ long, with the ends rounded, and two 5/32-in. reamed holes in it at $1\frac{1}{4}$ in. centres. At $\frac{1}{2}$ in. from one hole, drill and tap a $\frac{1}{8}$-in. or 5-B.A. hole for the drive pin.

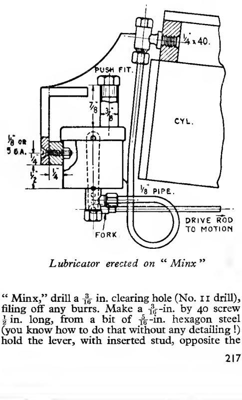
The eccentric-rod and strap are made exactly as described for the pump eccentric on the link-motion "Maid," the distance between centre of strap and holes in fork being 6 in. It is pinned to the bottom of the swinging link with a bit of 5/32-in. silver-steel. Erect as shown, screwing the bracket to the motion-plate by two 5/32-in. or 3-B.A. screws, and attaching the swinging link by a bolt made the same way as those described for Joy anchor links. The drive-rod is made up and connected to the swing link, in precisely the same manner as described for the "Maid of Kent," the assembly being shown in the illustration.

Drive for the Joy-geared Engines

On the Joy-gear engines, the pump occupies the middle of the motion-plate, and prevents any idea of getting a drive from there, without using a rod like Harry Lauder's famous walking stick; so we must make other arrangements. On "Grosvenor," I have used a rocking-lever, the top part connected to the valve fork, and the lower to the ratchet lever by a rod going under the cylinders. It works fine, so I am specifying a similar drive for these engines. "Grosvenor's" rocking-lever works in a bracket on the motion-plate, but in the present case we can do better by substituting a stud on the frame, as shown in the illustration.

Our advertisers may be able to supply a casting for the rocking lever; but it can be easily made from a piece of $\frac{1}{2}$-in. by $\frac{3}{16}$-in. bar, either steel or brass, about 3 in. long. File to shape, scribe a line down the middle, and drill three No. 40 holes at $1\frac{1}{4}$ in. centres. Tap the top and bottom holes $\frac{1}{8}$ in. or 5-B.A. Turn a pip about $\frac{1}{8}$ in. long on the end of a piece of $\frac{1}{2}$ in. round rod, to fit the middle hole tightly, and part off $\frac{1}{8}$ in. from shoulder. Drive this in, silver-solder it if brass, braze if steel, then chuck it in three-jaw and put a $\frac{1}{4}$-in. drill through the lot, pin-drilling the lever $\frac{3}{8}$ in. diameter and $\frac{1}{16}$ in. deep as shown in section. Lever is the same both for "Maid" and "Minx."

You can't get an ordinary stud in position on the "Maid," due to the guide-bar being in the way (see section) but there are more ways of "getting there" than travelling by "orthodox" routes, and we can fix our stud from the outside—which some folks wish they could do with collar-studs. Chuck a bit of $\frac{3}{8}$-in. round steel rod in three-jaw, face the end, centre, drill 5/32-in. or No. 21 for about $\frac{7}{16}$ in. depth, turn down a full $\frac{1}{4}$ in. of the outside to $\frac{1}{4}$ in. diameter (a nice fit in the hole in the lever) and part off $\frac{1}{16}$ in. from the shoulder. Reverse in chuck, and run a $\frac{3}{16}$-in. by 40 tap through it, then place it in the lever. Next, at 1 in. ahead of the motion-plate, $1\frac{7}{16}$ in. from the top of frame on "Maid," and 1 in. on

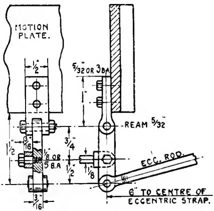


Lubricator erected on "Minx"

"Minx," drill a $\frac{3}{16}$ in. clearing hole (No. 11 drill), filing off any burrs. Make a $\frac{3}{16}$-in. by 40 screw $\frac{1}{2}$ in. long, from a bit of $\frac{5}{16}$-in. hexagon steel (you know how to do that without any detailing!) hold the lever, with inserted stud, opposite the

hole, and enter the screw into the tapped hole in in the stud, screwing home tightly. The lever should swing quite freely. Fit to right-hand frame.

Make a longer pin for the valve fork or cross-head, which should project a little over $\frac{1}{8}$ in. toward the right-hand frame, and connect it to the top of the rocking lever by an offset rod, made like a valve-rod, from $\frac{1}{8}$-in. by $\frac{5}{16}$-in. steel, attachment being made by a turned pin such as described above for the rod connected to the boomerang lever on the link-motion "Maid." The bottom of the rod is connected to the ratchet lever by a $\frac{1}{8}$-in. steel rod furnished with fork and drive head, exactly as described for the link-motion "Maid," bending same to clear the leading axle in the case of the "Minx," as shown. Note very carefully: adjustment should be made so that the ratchet clicks one tooth *when the engine is notched up*, so put the lever in next notch to middle, and connect the fork on the drive-rod, to the hole in the ratchet lever which gives the desired movement when the wheels are turned by hand. It doesn't matter two hoots if she

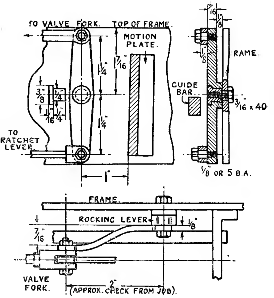


Drive for link-motion "Minx"

ratchets two teeth in full gear; no driver who knows his job ever runs with the lever "down in the corner."

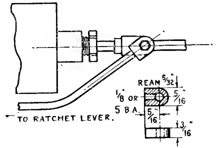
Drive for the Outside-cylinder Engine

This one is the simplest of all. Make an extended pin for the right-hand valve fork, same as specified for the Joy-geared engines, and connect this direct to the ratchet lever by a $\frac{1}{8}$-in. steel rod, with fork and drive head, getting the length of same exactly as described for the inside-cylinder engine. Take the same strict caution as before, to ensure that the ratchet clicks one tooth when the lever is in next notch to middle. Some folk are under the impression that it is all wrong to drive the lubricator from a point in the motion that has a variable travel, arguing that the movement of the ratchet lever should be constant. Personally, I don't see the importance of it, as I always run my engines with the lever right back as far as it will go without causing the engine to "kick" or "pound," so the ratchet



Drive for Joy-geared "Maid of Kent"

doesn't exceed the one-tooth movement on the run. When starting, the little extra oil supplied by the "two-teeth click" is rather beneficial than otherwise; on the old "Brighton" we made free use of the brass "dope cups" on the smoke-box, to pop in an extra shot of cylinder oil and tallow mixed, which helped to keep pistons and valves in first-class condition. We had no mechanical lubricators in those days. When I look back and ponder over what those pretty girls in their yellow dresses did with 150 lb. of wet steam, I wonder what sort of show they would have put up, if they had enjoyed the advantages of their not-so-pretty-but-much-more-filthy



Drive for outside-cylinder "Maid"

sisters of the present day. Little "Jeanie Deans" has given me some idea, but unless I miss my guess, little "Grosvenor" will give me a much better one!

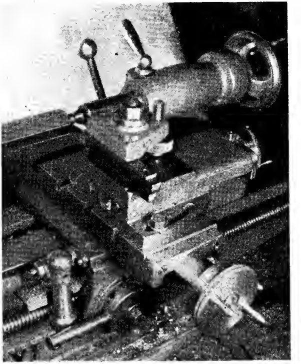
SLIDE-REST IMPROVEMENTS

by "Ned"

TO judge by the many articles and discussions on the subject, there must be comparatively few users of the cheaper types of lathes who have not attempted to improve them in some way or the other. Since the writer's articles on various lathe improvements appeared in the "M.E." before the war, there have been innumerable variations on this theme by other contributors, and, at the present time, it would appear that there is little excuse for any lathe user to tolerate serious faults in the accuracy of even the cheapest lathes, when they can readily be corrected by the intelligent application of the precepts and methods described.

That being so, it might be considered that there is little point in carrying the matter further; but it is hoped that some hints on the improvement of that most vital group of components which constitute the "slide-rest" of the lathe will be interesting and useful to many readers. There may be some people who think that a lathe, or other machine tool, should not be "tampered with" after it has left the maker's hands; and there is certainly much to be said for the policy of "let well alone," especially in the case of an expensive high-precision tool, in which the fitting and adjustment have been carried out with a high degree of skill which is beyond that of the average lathe user. But most lathes of the type with which we are concerned have only had the minimum skilled hand work put into them by the makers—for obvious economic reasons—and are susceptible of considerable improvement by discreet attention to details. Moreover, even the best lathes becomes inaccurate in time, due to wear, or (much more often!) abuse, and call for refitting or adjustment of their components.

The need or desirability for improving a lathe does not necessarily arise through actual imperfection of fit or accuracy; often its object is to increase scope, adaptability or handiness of manipulation. In many respects, ideas on what constitutes actual improvement may vary, and just as with basic design and specification, the individual user may have very strong views on what constitutes the "ideal" features of a lathe; this matter is also influenced by the class of work in which the user is primarily interested, and the conditions under which the tool is used. For this reason, the writer makes no attempt to dictate what form improvements should take, but describes only details which have been found useful in his particular case.



Slide-rest of Myford ML4 $3\frac{1}{2}$-in. lathe, with modified slide handles incorporating disc indices

But whatever may be the views of the individual in respect of design or detail, there is at least one point on which all users are agreed: that is the importance of perfect fit and smooth action of all working parts in a lathe, and in particular, the sliding surfaces of the saddle, cross slide and top slide, which components comprise what is still known by the old term "slide-rest" — a relic of the days when this fitting was a newfangled refinement, supplied as a separate attachment to replace the then more normal hand-rest.

Fitting Sliding Surfaces

In many cheap lathes, the accuracy and finish of the machined slide ways leave much to be desired, and the remedy in this case is obvious, though the user who is not skilled in fitting work of this nature needs to tackle the work with due discretion, or the last state of the job may be worse than the first. Given proper methods of procedure, however, accurate fitting is mainly a matter of patience rather than manipulative skill, though the latter will naturally facilitate the work and produce quicker results.

As most readers are aware, the most useful tools for slide fitting are scrapers of appropriate shapes, though in many cases filing may have to

be resorted to, and for the normal type of slide, fairly large 60-deg. "three-square" files, in second-cut and smooth grades, are most useful.

Test strips, of the shape shown in Fig. 1, and of suitable size to go in the inside slide ways, may be made from rectangular steel or cast-iron bar, and should be carefully filed and scraped, the edge being at 60 deg. to the flat face (this angle being practically universal at the present day,

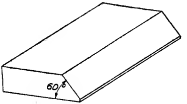


Fig. 1. Test strip for fitting vee slides

though other angles have been employed in some of the older types of lathes). Test the angle with a protractor, and use a surface plate or a piece of heavy plate glass to test the flatness of both test surfaces, using marking pigment to show up high spots. Take the utmost care in producing the test strip, as, should it be inaccurate in any essential respect, the errors in the finished work must obviously be at least as great, and probably greater.

The technique of filing and scraping true surfaces cannot be learnt from a text-book or article, and skill in this work can only be acquired from practice. All that the writer can do is to guide the operator in respect of method; it is assumed that the latter has some basic knowledge of the use of these tools before starting a job of this nature.

One of the first things to be done when fitting a slide rest is to check the parallelism of the non-adjustable member; in many cases a perceptible error will be present, due to wear or initial inaccuracy of machining, and this should be corrected right away. It is, however, very difficult to measure accurately between angular surfaces, and the method generally employed in this case is to use "rollers"—straight pieces of precision-ground silver-steel bar will serve—inserted in the inner angle of the slide, measuring the distance between them with callipers or other suitable form of gauge, to ascertain if any taper is present. (Fig. 2.) This check should be made, not only at the start, but at various stages as the work proceeds, as it is possible to introduce errors in the process of producing angular truth and flatness of the surfaces. The distance of the slideways from the edge of the slide should also be checked in the manner shown in Figs. 3 and 4.

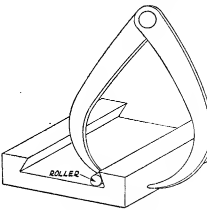


Fig. 3. Checking parallelism of female slideway with edge of slide

When filing and scraping internal angles, it is neither practical nor desirable to produce these to a dead sharp corner; a fillet must necessarily be left, and it is most important that the corner of the mating slide should be chamfered or rounded off to clear this, erring if anything on the liberal side. If this is not done, one may produce perfectly true surfaces on both sliding components and still not have a properly fitting slide, as the corners of one part will merely be "riding" on the fillet of the other. This is a much more prevalent fault than is often realised.

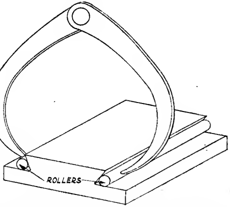


Fig. 2. Checking parallelism of male slide with the aid of rollers

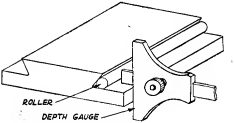
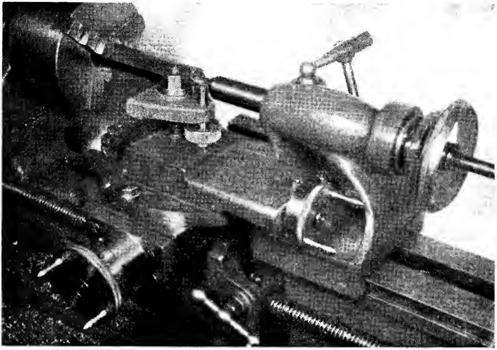


Fig. 4. Testing parallelism of male slideway with edge of slide

For the rest, fitting is mainly a matter of care and patience—testing with the test strip, smeared lightly with marking to show up high spots—

scraping these away—applying the test strip again—and repeating the process, *ad infinitum*, until the desired result is achieved. If the operator considers that this sort of work is all too tedious and time-wasting—well, the only alternative one can suggest is to buy a slideway grinder at a cost of about £1,500 or so! There are no short cuts to slide fitting—but let no one believe that the time spent on this job is wasted; it will all be repaid by the results achieved later in using the lathe.

The idea of lapping slides to fit each other has often been discussed, but as a means of producing accuracy from inaccuracy, it may be dismissed as impracticable. In this respect it differs considerably from circular lapping, which can be made to correct inaccuracies of circular form if properly used; lapping of flat surfaces is more likely to perpetuate or increase existing errors. In other words, one is a *generating* process, the other a mere *copying* process, and not too efficient at that. Nevertheless, lapping of slide surfaces has been usefully employed, mainly as a final finishing process, and it is believed that some of the best precision lathe slides were finished in this way. If used at all, however, it should supplement rather than supplant the normal methods of fitting, to produce the final "silkiness" of movement which characterises the high-class machine tool; and the greatest care should be taken to prevent the abrasive from "working overtime"—in other words, to ensure its thorough removal after it has performed its useful function.


Another view of the modified slide-rest, showing how close an approach to the lathe centre is possible with tailstock in use

Adjusting Gibs

In many of the cheaper lathes, the gibs which adjust the fit of the slides are very unsatisfactory, being merely strips of mild-steel, the edges of which are not bevelled to the angle of the slides, and they are imperfectly located by the points of the adjusting screws, which make contact with drill-point indentations in their back surface. It will often be found profitable to make new gib-strips, of such a section that they fill the space between the slides as perfectly as possible, and bed properly into the angle of the female slide. The contact surface of the gib should be finished just as carefully as that of any other working surface, and here it will be apparent that a very thin gib-strip, which is easily deflected, leaves much to be desired. Many of the older lathes had very heavy gibs, which could be secured firmly to the slides by vertically fitted screws, and these were much more satisfactory, but tended to make the slides bulky, and sometimes clumsy.

The gib adjusting screws should have fairly acute points, bedding properly into the indentations of the gib-strip, and as deeply as possible without involving risk of penetrating through so as to foul the sliding surface. Wherever possible, lock-nuts should be fitted to the screws so that adjustments can be properly maintained; but

in many cases the screws are so close to the edge of the slide that this measure is impracticable. The only thing one can do in such cases is to offer some deterrent to the loosening of the screws, and one method which has been found fairly effective is to apply varnish to the threads before inserting them. When the varnish dries it will gum up the threads sufficiently to prevent them shaking loose, but not to make their subsequent removal or adjustment unduly difficult; the treatment must, of course, be renewed whenever the screws are shifted.

Indices

This is a subject which has been dealt with fairly fully in the "M.E." by Mr. Ian Bradley and other contributors, and therefore need not be considered in very close detail. There is no doubt whatever about the value of a graduated index on each of the slide screws of the lathe—in fact it may be considered practically indispensable for really accurate work. It is true that the machinists of a past generation managed to carry on without indices on their slide-rests; but without disparagement of their undoubted skill, it may be said that they generally worked to "fit and feel" rather than to exact measurements.

Wherever possible, indices should be graduated to read in increments of thousandths of an inch, though this may be difficult if the threads of the lead screws are of a pitch which is not convenient for dividing in this way. The slide screws of many small lathes are cut to a pitch of 12 t.p.i., so that one turn represents a slide movement of 0.083 in. In many cases, the index for such a screw is marked with 80 divisions, giving an error of 0.003 in. per turn, which is not very great, but being on the "plus" side, may possibly lead to taking just a little too much off when taking a final cut, if the index is relied upon. A "minus" error is preferable, and in one or two cases the writer has marked indices for 84 divisions. A figure divisible by 5 is, however, more convenient in some circumstances, and, 85 may be found the most useful all-round compromise. Many years ago, the writer suggested to makers of lathes having 12 t.p.i. slide screws that it would be a great improvement to alter the pitch to 12.5 t.p.i., so that 80 divisions would give exact thousandths of an inch; but the complications likely to result over spares and replacements made such a modification difficult in practice.

Most contributors who have described the construction of indices for lathes insist that they must be adjustable, i.e. capable of being set to zero at any point in the slide travel. The writer does not, however, regard this as an indispensable feature; the fixed index has rarely been found an inconvenience, and in at least one respect is actually preferable—it cannot be accidentally shifted relative to the screw after the initial reading has been taken. On the Myford ML4 lathe which has for some years formed the staple item of the writer's equipment, large-diameter indices have been fitted to replace the original ball handle of the slides, and the value of these has been proved on innumerable occasions.

Whatever type of index is fitted, the most essential thing is that the graduations can be clearly seen, without having to peer closely at them or take an inconvenient angle of view, at a point which is perhaps imperfectly illuminated by the normal lighting of the workshop. Herein lies the value of a large-diameter index, with open scale graduations on the periphery, which should be parallel to the axis or at only a slight bevel. A small-diameter disc, graduated on the face, or a shallow bevelled index, leave much to be desired in this respect.

It is sometimes difficult to fit a large index really neatly in conjunction with the usual form of ball handle—the method of mounting the latter on the lead screw, by the way, is often rather unsatisfactory—and that was the reason for changing the type of handle in the case illustrated. The discs are secured to the shanks of the slide screws by grub-screws, and end-located by sunk lock-nuts, no trouble of any kind having been experienced with this method of fitting. The cross slide index is $2\frac{1}{4}$ in. diameter, and that of the top slide $1\frac{3}{4}$ in. diameter. If anything, the balanced double-crank handles are more comfortable to manipulate than ball handles, and a further advantage, in the case of the top slide, is the compactness of the arrangement, allowing a closer approach of the slide to the lathe centres when the tailstock is in position, and the removal of the risk of "trapping" the handle under such conditions, which very often occurs with ball handles. However, this is one of the features of design on which opinions may differ, and individual users have a right to their own preferences in such matters.

While on the subject of indices, the graduating of the top slide base, to indicate angular settings, may be mentioned. Some ML4 lathes have been supplied with graduated top slides, but the one illustrated was not, and the job was tackled when other work on the slide rest was in hand. The top slide was dismantled, and the sole-plate was clamped to the lathe faceplate, with the pivot hole carefully centred. The edge of the front flange, not having been machined at the works, was shaped to a true arc by pulling the lathe round, through part of a circle. (It may, incidentally, be mentioned that as the top slide was not available for holding the tool, a fixed tool-post was mounted on the cross slide for this purpose.) Dividing the edge of the soleplate in increments of five degrees was carried out by the aid of a worm indexing attachment of the type described in "Milling in the Lathe" in the "M.E.," using a 60-toothed change wheel on the mandrel and a 120-hole division plate. As five degrees equals 1/72 part of a circle, the index was moved 100 holes for each division, producing $\frac{100}{60 \times 120}$ = 1/72 revolution of the mandrel.

Other Minor Improvements

During the early part of the career of the ML4 lathe, some trouble was experienced with the fit of the set-screw which locks the top slide in position. There are two positions for this screw, in tapped holes in the cross slide, for convenience

(*Continued on page 225*)

IN THE WORKSHOP

by "Duplex"

* 18—Drilling Machine Depth-Stops and Gauges

ALTHOUGH a special pin-drill had to be made for this purpose, this was done very quickly in the following manner, as represented in Fig. 8. A short length of $\frac{5}{16}$-in., round silver-steel was set to run truly in the four-jaw chuck; the end was faced; a $\frac{1}{8}$-in. centre drill was run in for a short distance, and this was followed by a $\frac{1}{8}$-in. drill fed to a depth of $\frac{1}{2}$ in.

The work was then clamped in the vice and a cut with a fine hacksaw was made across the diameter of the end to a depth of $\frac{1}{16}$ in. at the periphery, but sloping upwards towards the centre as illustrated at *a*, Fig. 8. As shown at *b*, Fig. 8, two further saw-cuts were made to form the cutting lips, and these were then finished to shape and sharpened with a fine file, as shown at *c*, Fig. 8.

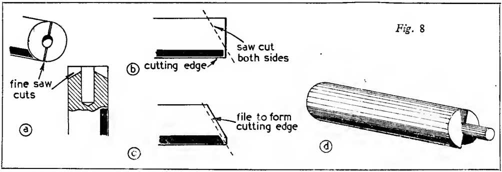


Fig. 8

After the cutter had been hardened by heating it to a bright cherry-red and then cooling it in water, it was tempered to a straw colour. Finally, a silver-steel guide peg $\frac{11}{16}$ in. in length was fitted, and the finished tool had the appearance shown at *d*, Fig. 8.

After the pillar seating has been formed with the pin drill, the $\frac{1}{8}$-in. diameter guide hole is drilled to the tapping size; but before this hole is tapped it should be enlarged to the clearing size for a depth equal to one-and-a-half threads to prevent a burr being set up on the seating by the tapping operation.

The pillar *A* is turned and then threaded in accordance with the dimensions given in the drawing, Fig. 9. A length of 4-B.A. nut-size hexagon rod will be found suitable for making this component.

The finger-nut *B* is a straightforward machining job, but it should be noted that it is provided with a spring and pad-piece secured by a grub-screw, as shown in the detailed drawing; this gives smooth, frictional control and prevents the nut turning under the stress of vibration.

When the stop-pieces *C* have been machined, they are attached by cheese-headed screws to the threaded side members, and lock-nuts are fitted on the outer side to afford greater security.

The holes to receive the $\frac{1}{8}$-in. screws are drilled 31/32 in. from the centre-line of the trunnion bearings, in order to allow the stop-pieces to bear close to the centre-line of the finger-nut in all positions of the feed gear.

This completes the drilling stop, and when the parts are assembled it should be found that the stop-pieces bear equally on the finger-nut when tested with two strips of cigarette paper.

The Depthing-Gauge

The dimensions of the angular bracket *D*, which is made from mild-steel, are given in the detailed drawing; but after it has been marked-out and before it is cut to shape, the hole to receive the pillar is drilled and reamed; the hole for the pillar fixing-screw is drilled, counter-bored, and tapped, using the same pin drill as before; the hole for the rule clamping-screw is drilled and tapped, and the hole to house the friction-pad and spring is drilled to meet the previous hole; finally, a hole is drilled to mark the limit of the saw-cut through the rule clamping portion of the bracket.

Next, the material is slit as far as the latter hole by means of a circular slitting-saw mounted on an arbor between the lathe centres. For this operation the work can be secured in the lathe tool-post, if of the English pattern, and it is essential that the saw should be set to run truly and at a moderate speed.

The final machining operation is to form the dovetailed slot to hold the rule. The bracket is secured in the machine vice, attached to the vertical slide mounted on the lathe boring table.

When the work has been correctly lined up

* *Continued from page* 174, "*M.E.*," *August* 12, 1948.

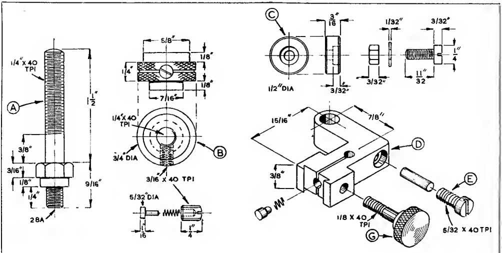


Fig. 9

from the face of the chuck, a vertical slot is cut on its end face with a $\frac{3}{8}$-in. end-mill to a depth of $\frac{1}{16}$ in. The dovetails are then cut by means of a fly-cutter whose side cutting edge has been ground and stoned to an angle of approximately 60 deg., as represented in Fig. 10.

The actual tool used in this instance was a small boring tool with a round shank, and for the machining operation it was mounted in the self-centring chuck. It is essential, of course, that the point of the tool should revolve on a radius of less than $\frac{3}{16}$ in. to avoid cutting into the slot already formed by the end-mill and thus reducing the overhang of the dovetails.

The two walls of the slot are then machined until satisfactory dovetails are formed which will have a sufficient bearing on the edges of the rule.

The dimensions given in the drawings are suitable for mounting a thin rule of $\frac{1}{2}$ in. width.

The next operation is to fit the rule into its slot. To do this, the rule is held in a small vice so that, as shown in Fig. 11, its edges can be filed to an angle of 60 deg. to match the dovetails.

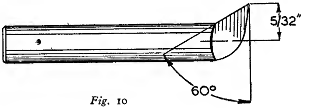


Fig. 10

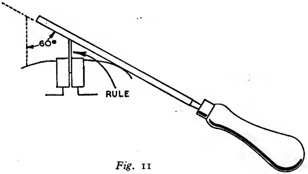


Fig. 11

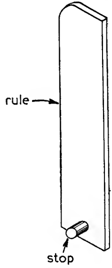


Fig. 12

After the edges have been filed in this way, the final fitting is carried out by using an oil-stone slip in the same manner in order to give a good finish to the sliding surfaces.

The pad-piece and spring, as shown in the drawing, are now fitted, and the length of the spring should be adjusted to give firm but smooth frictional control of the rule.

The small springs used here and in the finger-nut are easily made from portions of spring of the sort fitted to petrol lighters.

Should the rule be inadvertently raised too high in the bracket, the pad-piece will be uncovered and may escape; to obviate this, a small stop-pin should be fitted to the lower end of the rule, as illustrated in Fig. 12.

The rule fitted has graduations $\frac{1}{8}$ in. apart, as this lessens the possibility of making the errors of reading which are apt to occur when fine graduations are used; moreover, no difficulty should be experienced in reading accurately to $\frac{1}{16}$ in. with the sharp-pointed indicator fitted.

The clamping-nut G is a straightforward piece of work, and, when fitted, it should be found that only light turning pressure is necessary to secure the rule firmly in place.

On completion of the machining and hand fitting, the bracket is formed to shape with the hacksaw and file, and its edges are rounded or chamfered.

To prevent damage to the pillar, the bracket locking-screw E is provided with a brass pad-piece which is turned to the correct length to allow the screw to lie flush with the surface of the work.

The thrust block is drilled and then tapped 3/32 in., or 7 B.A., to receive the index pointer H, which is mounted in the centre-line of the trunnions to bring the point exactly opposite to the edge of the rule.

Using the Depth-Stop and Gauge

If the depth of the hole is to be taken from the point of the drill, the drill is brought down to bear on the work and the depth-gauge is set with its zero mark opposite the pointer; when several holes of equal depth have to be drilled, the work is moved aside and the drill spindle is fed downwards until the pointer registers the required depth on the scale; the depth-stop is then set to this position and further reference to the scale during the drilling operation will be unnecessary.

When, on the other hand, single holes only are being drilled, it will usually be found quicker to feed the drill downwards until the pointer indicates on the scale that the requisite depth has been reached.

If the depth of the hole is measured from the point where the drill cuts to its full diameter, then the scale is set to the zero position as soon as the drill point has fully entered the work, and the depth of the hole is determined as in the previous case. As the depthing-gauge and the stop can be readily set with one hand, there is no need to stop the machine for this purpose.

Slide-rest Improvements

(Continued from page 222)

at different angles of the slide, but either can be used when it is set for parallel turning. The threads of both holes stripped, however, and it was found necessary to open them out to $\frac{1}{2}$ in. B.S.F. and insert internally and externally screwed steel bushes, which were made to fit tightly so as to "stay put," and have remained so ever since. It may be put on record that the pivot stud on the cross slide, and the tool post stud on the top slide, have never given any trouble, though they have had very hard use. This is mentioned because some users of similar types of lathes seem always to be pulling out or stripping these studs, but a great deal depends on knowing exactly how much strain a stud or other screwed fitting may be *expected* to stand up to. One encounters fitters sometimes who think that the only limit to the screwing up of a nut should be that of a man's entire strength, aided by the longest tommy-bar or lever available!

Although not strictly a part of the slide rest, the tailstock may be briefly mentioned in dispatches. The main operation on this was the marking of a graduated scale on the barrel, which is extremely useful in measuring the depth of drilled holes. Before removing the barrel, a plug was made to fit its taper socket, having a head turned to the same size as the outside of the barrel, to act as a steady when the latter was reversed and held by the screwed end in the chuck. It was then possible to support the socket end by bringing up the tailstock over the plug steady. Dividing was carried out by using the lead screw, moving the latter half a turn at a time to give increments of $\frac{1}{16}$ in. travel. A point tool was used for marking, and in order to produce long and short lines on the scale, to indicate $\frac{1}{16}$ths and $\frac{1}{8}$ths, blocks of wood were used as stops, to come in contact with the chuck jaws and limit the rotation as required. The scale should not be cut along the top of the barrel, but will be much more clearly visible at about 45 deg. to the front side.

At a later date, an index disc was fitted to the lead screw of the lathe; this, having eight threads per inch, was marked with 125 divisions, using the worm indexing gear as before, with a 60-toothed change wheel and a 100-hole division plate. The index was moved 48 holes each time, producing $\frac{48}{60 \times 100} = 1/125$ revolution of the mandrel.

A 1.5 c.c. Compression-ignition Engine

by "Battiwallah"

THE popularity of small compression-ignition engines prompts one to describe the construction of one of these power units.

Should any doubts as to their popularity enter into the mind of an intending user or constructor, let him either attend one of a model aircraft club's meetings, or study the various trade advertisements of suppliers of these engines. I make bold to say that the small compression-ignition engine has been a very important factor in the popularising of power-driven model aircraft. I very much doubt that the same prevalence of power-driven craft would exist today if the model flying enthusiasts had to depend upon petrol engines. But let me make myself clear on this point, for I do not wish to decry the little petrol engine ; the principal reasons why the compression-ignition units have gained such sway is because of their simplicity, their overall high power-weight ratio as compared with petrol engines, because they are available in small units, and lastly, but by no means the least, they are much cheaper to buy than petrol units.

It is also right to explain that in submitting this description for constructing an engine, it is not the intention to counter in any way whatsoever any trade interests. Model engineers are a specie who will have a crack at constructing anything that interests them and which lies within their attainments and facilities, and it is as one of this peculiar breed that I offer notes of guidance, gained with experience, to those of my fellows who are interested.

Specification of the Engine

The engine which will be described in full detail is a 1.5-c.c. model with die-cast aluminum crankcase and front bearing end-plate. All working parts are made of case-hardened steel, including the cylinder but excluding the connecting-rod which is aluminium alloy. The engine will be suitable for propelling model aircraft, boats, or cars.

Every operation involved in the construction of the engine can be carried out in an amateur's workshop which is equipped with no more than a reasonably good lathe, the usual collection of essential hand tools, and facilities for melting small quantities of aluminium.

Every operation will be accompanied with notes on "how and why" for those less familiar with the precision methods which an amateur can attain in his own workshop, for there is something unique in machining working-fits of ± 0.0002 in. in model engineering ; I think it is unusual in most other branches of our art ; oh ! yes, I know what I am talking about for I have made a few $3\frac{1}{2}$-in. gauge locomotives, and petrol engines, and lots of other things too ! But do not let this mention of such a fine working limit deter you. There are no mysteries, and it is not difficult. All that is needed is a little patience and if you do spoil a part you will not have lost a lot of time nor incurred expense, for you will probably be able to find most of the materials required for making the engine in your scrap box.

The general arrangement and the principal dimensions of the engine are shown in Fig. 1. It will be seen that there are no complicated machining operations, and in the making of the various parts no complicated set-ups are required. Once the moulds for the die-castings have been made, and these are also simple jobs, the rest of the work is quite straightforward. In fact, if the constructor is already well skilled in the arts of accurately finishing, where precision fits are vital, the complete engine can be made in a matter of thirty or so working hours. The mention of the time element is quite incidental, however ; we are not concerned in cutting the time of construction to a minimum.

Before we get down to the construction of the dies for the aluminium parts it is as well to have a little talk on the ways and means of die-casting from the strictly "amateurish" point of view.

Simple Die-casting

Let me say at the beginning that I do not claim the methods as being "production" methods ; they are far from it, for the dies are much too light and the procedure much too slow. The methods will, however, produce results satisfactory in every way, provided, of course, recommendations are adhered to. The castings will be sound, free from blows or pores, accurate in dimensions, and of pleasing finish. The dies can be used many times, for with care they can be kept in good shape in spite of the lightness of their construction. Moreover, should one have the bad luck to spoil a casting, another can soon be made. There are other advantages in having one's own dies, too.

As will be seen from the drawings of the dies, the construction is simple and no heavy machining is required. Stock mild-steel bar or flats will be quite good enough, and reasonable care in machining will ensure satisfactory results. For instance, one would not leave an interior surface which forms the casting with rough file marks which run in a direction at right angles to the direction in which the casting would be drawn from the die. That would just be asking for trouble because, in all probability, the casting would be held by the die in a vice-like grip.

The coefficient of expansion of aluminium, and most of its alloys, is about twice that of iron or steel ; in the casting process the aluminium is heated to at least twice the temperature (by thermometer) of the die so that the aluminium contracts something like four times as much as the die. We must carefully watch then, that in making the dies, no parts thereof will be gripped by the casting on cooling. Where the tendency to gripping occurs, the die surfaces concerned must be relieved in a way which

will enable the casting to be easily removed from the die. When we come to the construction of the dies, this matter will be further explained; but it is quite an important one, and in consequence, special mention is made of it, lest one should unwittingly encounter this "snag" in making departures from the constructional details which are given.

get rid of them—and these will provide all the metal you will need.

The melting-pot need be only a food-container can cut down; it serves splendidly provided it is not overheated, which can easily be done if a forge is used. If the container is tinned or soldered, burn it off at a dull red heat for a few minutes to remove all traces of tin, otherwise,

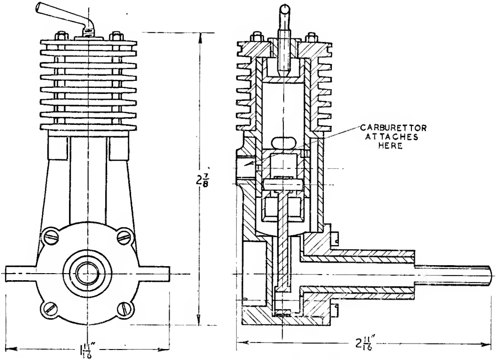


Fig. 1. General arrangement of the 1.5 c.c. compression-ignition engine

The headers are also quite important; without them the castings will lack that sharpness and perfection in form which is obtained when headers are used. Their use necessarily means melting more metal than is actually needed in the casting, but there is no need to worry about that. The headers can be sawn off when the castings are cool and melted down again with make-up metal if other castings are required. Also they make useful bars of material for other jobs.

There are no great difficulties about melting the aluminium or many of its alloys, except duralumin. This metal requires greater heat, or it seems to do so; I have had less successful results with it than with other alloys and it is for this reason that I recommend not using it, unless, of course, you know how to treat it and possess the necessary facilities for doing so.

Very satisfactory results can be obtained with motor-car engine pistons. It should not be difficult to obtain two or three discarded pistons from your local garage—a good many garage proprietors will be only too glad of a chance to

if this is not done, the first batch of metal melted will be contaminated. Contamination by the smallest amounts of other metals should be avoided as far as it is possible to do so, or else there is a chance that the castings will either be porous, or have inferior tensile strength.

The metal should be at a dull cherry red for pouring. Just as it is getting to this heat, but not immediately before pouring, sprinkle a little borax on the surface of the molten metal. With a bent strip of iron very gently stir the metal for a few seconds to bring all dross to the surface and then let it stay for a few minutes. Remove the dross just before pouring, but when doing so do not stir the metal, or you will probably aerate it and a porous casting will result.

For melting the metal in small quantities, that is to say a pound or so at a time, a one-pint blowlamp and a clean coke bed for the melting-pot will suffice, although if another lamp is available, this operation can be carried out more quickly, for one blowlamp can be arranged to play on the base of the pot and the surrounding coke whilst the other lamp is used for melting down the

piston or ingot, whichever it is. If only one lamp is available, the task can be quite successfully performed; first melt the mass of metal by playing the flame directly on the metal. It will probably solidify as it falls to the bottom of the container, but with the lamp flame concentrated on the bottom of the container and the surrounding coke, in a matter of ten minutes or a quarter of an hour the mass of the metal can be brought to pouring temperature. It is as well to keep the top of the container covered with a piece of refractory material as this helps to prevent the loss of heat, and it also tends to reduce oxidisation of the metal.

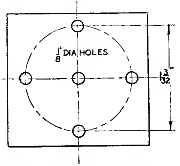


Fig. 2. Template for the end-plate and crankcase drillings

If the means of heating the metal is a forge or a coke furnace, do not force the heating in the preliminary stages. If you do, you will probably burn away so much of the container, if it is a can, that by the time the metal is melted, there will be a hole in the bottom of the can! If, on the other hand, you are a fortunate possessor of a proper refractory crucible, so much the better, for you can hardly go wrong; don't forget to keep the top covered, however, when the metal has melted.

Well, these are a few useful tips to those who have not tried their hand before at casting aluminium; a lot more can be said, of course, but what has been said on the ways and means of melting should suffice to enable the intending constructor to decide whether he has the means to do the job.

And now we are all set to go ahead with the construction of the dies; two are needed, one for the crankcase and one for the bearing end-plate. Let us begin with the easiest one.

Making the End-plate Die

In the general arrangment drawing, Fig. 1, it will be seen that the front end casting, which houses the crankshaft bearing, is secured to the crankcase by four set-screws which are screwed into lugs on both castings. We like to see these lugs registering neatly on the assembled engine, and as it is rather awkward to ensure this if the two dies are independently marked off, it is as well to make a drilling template from a piece of $\frac{1}{16}$-in. plate. This is shown in Fig. 2. The central hole enables the template to be positioned for marking off the holes.

To settle any questions which may be asked about the allowances which ought to be made for contraction, just note that for our purposes the answer is nil; the parts are quite small and what little contraction there may be is compensated by the expansion of the die when it is heated prior to pouring.

The end-plate die, Fig. 3, is in three parts excluding the header. Take a disc of $1\frac{1}{2}$ in. diameter mild-steel $\frac{5}{16}$ in. thick and put a $\frac{1}{8}$ in. diameter hole truly through the centre of it. Using a short peg of $\frac{1}{8}$ in. diameter material to centralise the drilling template (Fig. 2) mark off four holes with an 1/8 in. diameter punch; also be careful to note which side of the template you have worked from, so that you can use the proper side when you use the template again for the crankcase die. If you forget this little point the register of the lugs on the two castings may be a trifle out, unless the template is quite accurately marked off. Drill a $\frac{1}{8}$-in. hole through the work at each of the marked-off positions and open these holes out to $\frac{1}{4}$ in. but not the centre one.

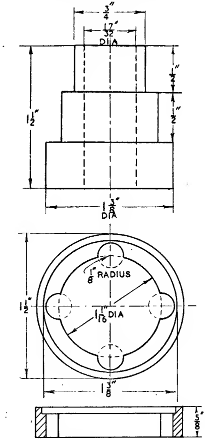


Fig. 3. Die for the end-plate casting

(To be continued)

*An Experimental Cylinder-Head

by J. Latta

THE absence of a rapid circulation round the cylinder enables it to warm up quickly and attain a fairly high but even temperature.

The water outlet is taken from the highest portion of the head, the lid of the water space being slightly sloped so as to avoid trapping any steam that might form.

One or two simple tests with a dial indicator against a valve on the old engine, showed very definitely that the amount of spring which can occur in the valve-gear is very considerable; so much so, that I was often surprised to find how many degrees of valve timing were lost when compared with what the cam was designed for. The original rocker supports being made of sheet-metal were obviously a bit springy, so the new rocker bracket was deliberately made very hefty with a 9/32-in. diameter solid spindle for the rockers.

Fig. 5. The partly brazed-up head. The cover for the water space is at the left.

As this support is bolted down to the comparatively thin lid of the water-cooled head, provision was made in the design to tie this down by a brazed-in strut; this strut can be seen clearly in Fig. 5, which shows the partly brazed-up head, the strut being the small rod towards the front.

It is doubtful whether a water-cooled head of this size is practicable as a casting; at any rate I felt that my pattern-making was not equal to the job even if the foundry could tackle it, and a fabricated job was decided on, built up by silver-soldering. Even so it is a formidable undertaking compared to the air-cooled version.

My experience with the usual type of split taper-valve collets had showed that these are not satisfactory for very high speeds, in spite of various modifications to the angle of taper; there was always signs of severe fretting of the groove in the valve stem, and I concluded that it would be necessary to devise a completely new type of fixing in which the spring collar was firmly secured to the valve stem without relying on spring pressure to keep the parts in position. Fig. 6 shows an enlarged view of the new arrangement, which up to date has given every satisfaction.

In this design the collar is screwed to the valve stem with a fine thread, and locked by a split tapered lock-nut, which, when tightened down, locks everything solid.

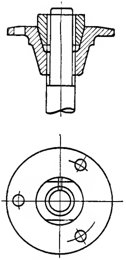


Fig. 6. Improved type of screwed-on valve spring collar used on the new head.

Two special hardened spanners were made, a tubular one for the nut, and a pin spanner for the collar. Sixty-five-ton nickel-chrome steel was used for the parts and every care was taken with the workmanship, both as regards the fit of the screw threads and the match of the taper.

There is a bit more work in making this fixing than there is with the ordinary type, but I have found it the only one to give permanent satisfaction at speeds over 10,000 r.p.m.

Double valve springs taken from the old head were used, as these matched the old cams, which it was proposed to use for the preliminary trials, so that I would be able to see whether the main modifications produced any improvement.

The old head used a 12-mm. plug, and I discovered that by a little wangling of the valve and plug centre there was just room to get in a 14-mm.

The alternatives were the 10-mm. Packard plug, and the ⅜ in. × 24 aircraft plug.

As finding a suitable plug had given more

*Continued from page 194, "M.E.," August 19, 1948.

Fig. 7. Cylinder and head assembled without the water jacket. Note the eight hex.-head bolts holding down the head, with the holes for the cooling water between them

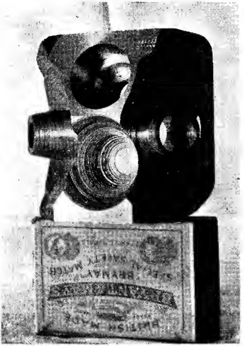


Fig. 8. The head was made from a piece of 3 in. square mild-steel. Photograph shows it after the preliminary rough turning and boring

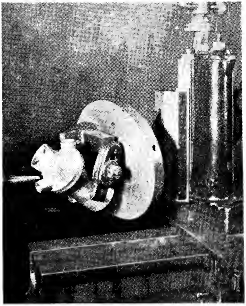


Fig. 9. Profile-milling the head

trouble than almost anything else with the old head, I gave the matter careful thought.

The advantage of the 14-mm. plug is, of course, the very wide range of patterns available, the 12-mm. being rather restricted in this respect.

The 10-mm. plug is even more restricted, and at the time I made up my mind the very few $\frac{3}{8}$ in. $\times$ 24 model aero plugs looked as if they were designed for very woolly engines and I decided to play for safety and fit the 14-mm.

It is questionable whether this was the right

Fig. 10. Head with valve guides in position ready for brazing. The rectangular bar served to keep the guides in position, and was removed afterwards

decision. The larger the plug, the more heat it picks up, and a very small plug could have been water-cooled right round instead of on one side only.

The old head was held down by four long 5/32-in. diameter studs to the crankcase, and I always had the feeling that they were not really

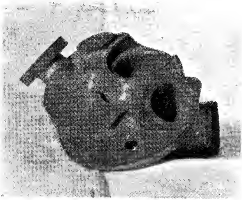


Fig. 11. *The head after the final brazing*

adequate to make the head joint as well as stand the peak pressure, which with a double figure compression ratio may approach 1,000 lb./sq. in., and as there is no harm in making sure, the new head was held to the barrel by no less than eight screws!

As it is practically impossible to bring these, even if fewer in number, to the upper side of

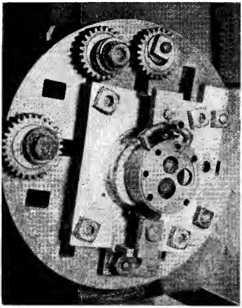


Fig. 12. *Machining the valve seats*

the head, they have to be put in from below as shown in Fig. 7, and are tightened before slipping on the water jacket.

This means that the jacket must be removed before the head can be lifted to get at a valve, which seems a terrible piece of design, but actually it is not a very difficult matter to do this; and

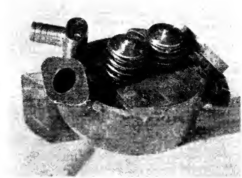


Fig. 13. *Valves fitted and water outlet in place*

decarbonising or valve grinding with this sort of engine is not the sort of job that needs doing to any extent, as the total running time is not likely to compare with a car or motor cycle.

The screwed ring by the way, that makes the lower water joint by tightening on to a round rubber washer, slips over the square flange of the cylinder by hooking it over two corners at an angle.

When the main outlines of the design were completed, I had to decide whether it would be easier to carve the combustion chamber top and ports out of a solid lump of metal, and braze the jacket on after, or whether the ports and plug boss should be made separately, and fitted

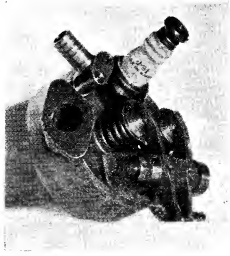


Fig. 14. *Nearly completed. Plug and rockers fitted*

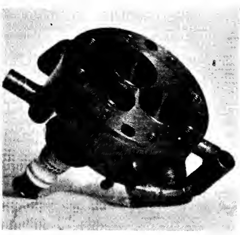


Fig. 15. *Underneath view of the head, showing valves and plug*

to the head which would be in the form of a disc.

I came to the conclusion that it would be better to carve from the solid, but before the job was done I wished I had tried the other method. Actually I don't think there would be much in it, there is a lot of hard work in it whichever way it is attempted.

A start was made by marking out a 3-in. sq. chunk of mild-steel, and the inside and outside of the ports were roughed out by turning as far as possible ; the recess for the plug was also cut, and as much metal as possible was removed by repeated chuckings.

The result after these efforts is shown in Fig. 8.

A chucking stub was then made to fit the underside of the head and secured by a bolt passing through the rough hole for the plug.

The piece was then held by the stub and set up in various positions on the milling spindle on the slide-rest, so that it would swing about the port centre-lines, etc., while a pointed end-mill in the lathe mandrel operated on the surplus metal.

Fig. 16. *Cylinder barrel, showing recesses for valve and plug*

Fig. 9 shows one of these operations in progress. Needless to say this part of the job was not easy, but did not take as long as one would expect, as a lot of soft steel can be removed fairly easily with a high-speed end-mill with a ball point.

Finally a little work with a file made quite a presentable job.

The valve centres were then marked out, and two holes bored through for the valve guides, or rather the supports for the guides ; the actual guides themselves being of bronze and pressed in later.

Fig. 10 shows the head at this stage, just before the guide supports were silver-soldered to the head. The large rectangular block of metal is to keep the two rods parallel during the operation.

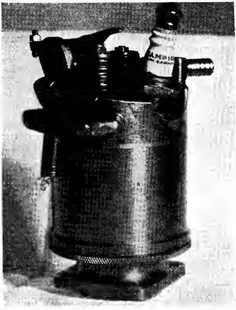


Fig. 17. *The completed job*

The tension-rod for the rocker support, previously mentioned, was then fitted and everything was then ready for the jacket to enclose the head.

This was made in two pieces as shown in Fig. 5. The first in the form of a short steel tube, cut away as necessary to fit the ports and the recess for the plug ; the other piece forms the flat lid, and is suitably thickened up where necessary for a platform to take the rocker bracket, and an oval flange for the water outlet. All this was carefully fitted into position and silver-soldered, and after a pair of oval flanges had been fitted to the ports the result was as shown in Fig. 11. The water inlet pipes were then made and fitted, and a pressure test given to make sure all the joints were sound.

The head was then ready for machining in the normal way, just as if it had been a casting.

Fig. 12 shows it on the faceplate, mounted on a jig plate for facing the spigot and machining the valve seats and guides. The six holes communicating with the cylinder jacket can be seen in this photograph.

The rest of the work was straightforward machining. Fig. 13 shows the valves fitted and the water outlet in place, and Fig. 14 shows it with the addition of the plug and rockers, while Fig. 15 is an underneath view of the head.

The cylinder was made from a solid piece of Sheepbridge Stokes cast-iron, and is, of course, machined all over. In Fig. 16 the recesses for the valves and plug can be seen, but the five holes for the cooling water are not yet drilled; they can be seen in Fig. 7, between the bolts.

The completed job is shown in Fig. 17. It looks a bit massive, but is not really unduly heavy and it is doubtful whether it would be as heavy as a comparable air-cooled job with proper finning.

The tests of the completed engine showed an improvement of about 15 per cent. in the brake mean effective pressure, and readers can take their choice as to whether this was due to the porting, water-cooling, or the general stiffness of the design; personally I am inclined to give the straight ports most of the credit.

Unfortunately, the extra power developed began to show up weaknesses in the lower end of the engine, so a design for a new crankcase is now in hand.

And so the game goes on!

Editor's Correspondence

A Locomotive Window

DEAR SIR,—I was much interested to see in the July 22nd, 1948, issue of THE MODEL ENGINEER a description of the tiled picture of G.W.R. No. 3012 at Swindon, as I have recently discovered in this city a representation of a locomotive in leaded lights.

The engine concerned is an L. & Y.R. six-foot 4-4-0. No. 898, the window giving the date of her construction as 1886. So far as I can tell, colouring and details are quite accurate. There are also two early views of Liverpool (Exchange) Station, but one of these is now obscured by an advertisement.

The windows are about 6 ft. from the ground and are those of the Railway Hotel, Tithebarn Street, directly opposite Exchange Station. Incidentally, these lights must have excaped destruction in 1940-41 (by enemy action) by a narrow margin.

Readers will find this engine a few yards on the pierhead side of a point opposite the main entrance to the Exchange Hotel.

Yours faithfully,
Liverpool. CHARLES LLOYD.

Slotted-screws on Locos

DEAR SIR,—May I propose a very hearty vote of thanks to Mr. A. E. Williamson for debunking the "slotted-screw" fetish. The figures he gives are both interesting and instructive.

Model engineering is saddled with a number of these strange ideas, and would be well rid of them. All too often, statements of opinion are made without any authority whatever, they are repeated by folk who should know better, and in due course are regarded as statements of fact, when in reality they are not.

I am not advocating indiscriminate use of slotted-screws—a cylinder cover held on with round-head screws would look dreadful—but if their use is justified, then it is only common-sense to use them.

A word of warning may be necessary, as most of the screws, nuts, bolts, etc., used in small-scale locomotives must be badly out of scale in order to secure adequate strength if the locomotive is intended to do hard work, and this defect is most obvious in the case of slotted-screws. The noble $\frac{3}{8}$-in. countersunk screws mentioned by Mr. Williamson, if reduced to $\frac{3}{4}$-in. scale, would be less than $\frac{1}{16}$ in. diameter!

I submit that if slotted-screws exist in the prototype, or if there is any other sound reason for their use, put them in the model; but keep them as near "scale" as the demands of strength will permit.

In conclusion, may I ask all competition judges to make sure they are in the right before they "dock" marks over the unfairly despised slotted-screw.

Yours faithfully,
London, S.E.9. A. L. HUTTON.

That Anomalous Treadle

DEAR SIR,—Further to Mr. Harris's, my own, and finally Mr. Latta's communications, so far from my having missed any points as suggested, I took Mr. Harris's re-"shortening threws," and commented thereon in my first letter, paragraph three, lines two to six.

Taking his concluding sentence, I join issue with him there, as I consider I dealt with this to point of dilation.

In the same paragraph he cites my 5-in. Milnes as having treadle connected . . . "*as Mr. Harris advocates.*"

Mr. Latta has never seen my lathe, nor have I ever described just how or where the connecting rods (chains in my case) are located on the treadle bars; so it seems our friend is writing without sufficient knowledge of the matter. In actual fact, my Milnes connecting-rod location is *exactly opposite* to that advocated by Mr. Harris in his dotted version, my rods (chains) being located exactly two-thirds forward (towards user) from the back pivots and directly under crankpins when these are on quarters (also towards user).

This gives me about 8 in. rise from the floor to the top of the treadle, with 2½ in. throw (or 5 in. stroke). Using a board I get 6 in. approx. That shown by Mr. Harris gives his about 14 to 15 in. rise with similar throw, and even if he were so ill-advised as to reduce throw to 1 in. he'd still have a rise of 6 in. and ineffective action, with his connecting-rod where he shows it.

The much derided "perpetual motion" one with the vertical and overarm motion gives a rise of 5 in. with the same stroke, which is even easier to treadle than my Milnes, and just about as powerful on heavy jobs, in which particular case the short throw/stroke would be no use at all, no matter where you fixed the connecting-rod.

Having criticised my poor journalistic efforts, it would at least have added a constructive interest to the discussion had Mr. Latta given us his views as to the object of this peculiar treadle, which I have, allegedly left "still unexplained."

Yours faithfully,

Penzance. HERBERT J. DYER.

Club Announcements

Kilmarnock Society of Model and Experimental Engineers

We recently moved into new premises, and have just finished "fitting out," and to mark the occasion, we intend having a formal meeting. This is to take place on Saturday, September 4th, 1948, at 3 p.m., the opening ceremony to be performed by Lord Howard de Walden, who is an honorary member of the Kilmarnock Club.

Our day is to take the form of an inter-club meeting, and invitations have been extended to Glasgow, Edinburgh, and other societies in Scotland, and we propose holding a "bits and pieces" session, and visitors are asked to bring anything of interest with them.

Our locomotive track, too, will be in operation, locomotives in 2½-in. and 3½-in. gauge will be run, and a happy, interesting day is anticipated.

Hon. Secretary: ROBERT M. CARR, 8, Townholme, Kilmarnock.

The North London Society of Model Engineers

At the August General Meeting, Mr. Stace received, on behalf of the Barnet District Gas & Water Co., the model water supply system which has been made by the Society as a token of gratitude for the many kindnesses shown. The model will be on display at the North London Model Engineering Exhibition, at Ewen Hall, High Barnet, on September 1st to 4th, inclusive.

In addition to the more usual exhibits, the following interesting items will be on show: Sound Recording Apparatus; Round-the-Pole Timing Apparatus; Model Marine Screw Testing Tank; Two Passenger-carrying Tracks, and the Society's Two-rail Miniature Railway. All will be working.

A number of the models will be brought straight from the MODEL ENGINEER Exhibition for exhibition at Barnet.

We do hope model engineers who visit the exhibition will make themselves known to us.

Hon. Secretary: N. M. DYER, 97, Selborne Road, N.14. Tel.: Palmers Green 2414.

The Malden and District Society of Model Engineers

The above Society are holding Locomotive Trials on Sunday, September 5th, commencing at 10.30 a.m., on their 880 ft. continuous track at Claygate Lane, Thames Ditton, Surrey, and all interested locomotive owners are cordially invited to compete.

To assist the organisers to maintain a continuous programme, to regulate the "time on track" factor, and to enable competitors to choose an approximate time for their running (not all competitors will want to attend all day), an application form will be available in due course and a copy sent to all applicants together with rules and other information.

Light refreshments will be available during most of the day. Forms and other particulars will be available from either the Hon. Secretary: G. F. TONNSTEIN, 7, Thetford Road, New Malden, Surrey; or from the Assist. Hon. Secretary: S. W. STEVENS-STRATTEN, 3, Coombe Gardens, New Malden, Surrey.

The Faversham and District Model and Experimental Engineering Society

On Thursday July 29th, a mixed party of members and friends of the above Society paid a very enjoyable visit to the Kemsley Paper Mills, of Edward Lloyd Ltd.

Another visit to the Boxley Pumping Station of the Maidstone Water Company, has been arranged for Thursday, September 9th, at 6.30 p.m. (time of starting from headquarters).

Mr Osmond will give a talk on lathe attachments at the next meeting on Thursday, August 26th and a hearty welcome is extended to all model engineers.

Hon. Secretary: R. W. PARTIS, 14, Edith Road, Faversham, Kent.

Dublin Society of Model and Experimental Engineers

The above society held a very successful exhibition in the Mansion House, Dublin, during the week July 5th to 10th, 1948.

The following awards were made by the judges:

Warren Trophy for best work shown, was won by S. Thornberry for his working model of a showman's "Hobby Horses." This model is complete with attendant caravans and showman's traction engine, and the builder is at present busy constructing the remaining mechanical and electrical contrivances found at a fair ground.

Porte Cup for the best locomotive running at the exhibition was won by E. A. Tramp for his G.W.R. "King" Class 2½-in. gauge locomotive.

The Judges' Prizes were awarded to J. A. S. Moran for an electric timing apparatus which has been used by the builder to time all car and motor-cycle speed trials, and hill climbs held in the Dublin area for some years, and to W. Propert, for two compression ignition engines, one of which was of the single-crank horizontally-opposed twin-cylinder type, with built-in rotary blower for cylinder charging.

The MacNeill Plaque was won by S. H. Knight, for a machine vice. This plaque is awarded by the society's president, Col. Niall MacNeill, for the best item of workshop equipment.

Thr Abbert Prize for working models was won by J. J. Carroll for a cabin cruiser. Mr. Carroll is well known in the society for his ship models, both sailing, and power, and this last example is well up to the usual high standard of workmanship of this builder.

The Junior Prize was awarded to B. P. Derlin, Jnr., for a number of "OO" gauge trucks and coaches, which showed very complete detail work in this small size, and were well finished and faithful copies of their prototypes.

Hon. Secretary: J. A. S. MORAN, 10, Nutley Lane, Ballsbridge, Dublin.

Leicester Society of Model Engineers

A hearty welcome is extended to all model engineers to visit our exhibition to be held for six days, August 30th to September 4th, in St. Marks Schools, Belgrave Gate. Monday to Friday, 2.0 to 9.0 p.m.; Saturday, 10.0 a.m. to 9.0 p.m.

Hon. Secretary: E. DALLASTON, 67, Skipworth Street, Highfields, Leicester.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. **All such correspondence should be addressed to the Editor (and not to individuals)** at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to THE SALES MANAGER, Percival Marshall & Co. Ltd., 23, Great Queen Street, London, W.C.2.

Correspondence relating to display advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 23, Great Queen Street, London, W.C.2.